

WHAT IS CLAIMED IS

1. A mass-analyzing method using an ion trap type mass spectrometer which is equipped with a ring electrode and one pair of end cap electrodes and
5 temporarily traps ions in a three-dimensional quadrupole field to mass-analyze a sample, comprising a first step of applying a main high frequency voltage to said ring electrode to form a three-dimensional quadrupole field,
- 10 a second step of generating ions in a mass analyzing unit or injecting ions from the outside and trapping ions of a predetermined mass-to-charge ratio range in said mass analyzing unit,
- 15 a third step of applying a supplementary AC voltage having a plurality of frequency components between said end cap electrodes and scanning the frequency components of said supplementary AC voltage, and
- 20 a fourth step of scanning said main high frequency voltage and ejecting ions from said mass analyzing unit and detecting thereof.

2. A mass-analyzing method using an ion trap type mass spectrometer which is equipped with a ring electrode and one pair of end cap electrodes and
25 temporarily traps ions in a three-dimensional

quadrupole field to mass-analyze a sample, comprising
a first step of applying a main high frequency
voltage to said ring electrode to form a three-
dimensional quadrupole field,

5 a second step of generating ions in a mass
analyzing unit or injecting ions from the outside and
trapping ions of a predetermined mass-to-charge ratio
range in said mass analyzing unit,

10 a third step of applying a supplementary AC
voltage having a plurality of frequency components
between said end cap electrodes and scanning said main
high frequency voltage,

15 a fourth step of scanning said main high frequency
voltage and ejecting ions from said mass analyzing
unit and detecting thereof.

3. A mass-analyzing method in accordance with
claims 1 and 2, wherein said supplementary AC voltage
has a predetermined frequency band (ω_1 to ω_2).

4. A mass-analyzing method in accordance with
20 claim 1, wherein the voltage (V_1) of any frequency
component of said supplementary AC voltage is at least
high enough to eject ions in resonance and the voltage
(V_2) of the other frequency component is high enough
to excite ions in resonance but not high enough to
25 eject ions in resonance.

5. A mass-analyzing method in accordance with
claim 4, wherein the low frequency component of said
supplementary AC voltage has said voltage value V1.

6. A mass-analyzing method in accordance with
5 claim 5, wherein said supplementary AC voltage in said
third step is frequency-swept from low frequency to
high frequency.

7. A mass-analyzing method in accordance with
claim 5, wherein a step is provided between said
10 second step and said third step to apply a wide-band
noise signal to said end cap electrodes to exclude
ions of a high-mass region.

8. A mass-analyzing method in accordance with
claim 6, wherein the frequency and voltage of said
15 supplementary AC voltage in said third step are fixed
and said main high frequency voltage is swept from
high voltage to low voltage.

9. A mass-analyzing method in accordance with
claim 5, wherein a step is provided between said
20 second step and said third step to apply a wide-band
noise signal to said end cap electrodes to exclude
ions of a low-mass region.

10. A mass-analyzing method in accordance with
claim 9, wherein the higher frequency component of
25 said supplementary AC voltage has said voltage value

v1.

11. A mass-analyzing method in accordance with
claim 10, wherein the voltage of said main high
frequency voltage in said third step is fixed and said
5 supplementary AC voltage is frequency-swept from high
frequency to low frequency.

12. An ion trap type mass spectrometer comprising
a mass analyzing unit having a ring electrode and one
pair of end cap electrodes, a detecting unit for
10 detecting ions ejected from said mass analyzing unit,
and a control unit for controlling a voltage applied
to said mass analyzing unit, wherein said control unit
applies a main high frequency voltage to said ring
electrode, forms a three-dimensional quadrupole field,
15 and applies a supplementary AC voltage having a
plurality of voltage components between said end cap
electrodes while ions are trapped in said mass
analyzing unit.

13. An ion trap type mass spectrometer in
20 accordance with claim 12,
wherein said supplementary AC voltage has a
predetermined frequency band (ω_1 to ω_2),
wherein the voltage (V1) of any frequency
component of said supplementary AC voltage is at least
25 high enough to eject ions in resonance and

wherein the voltage (V2) of the other frequency component is high enough to excite ions in resonance but not high enough to eject ions in resonance.

14. An ion trap type mass spectrometer in
5 accordance with claim 13, wherein said voltage V2 is set to be higher than the voltage of a frequency component of said voltage V1 and lower than the voltage of an opposite frequency

10 15. An ion trap type mass spectrometer in accordance with claim 13, wherein the frequency component having said voltage V2 is discontinuous.

15 20 25. An ion trap type mass spectrometer comprising a mass analyzing unit forming an ion trap volume with a ring electrode and one pair of end cap electrodes, a detecting unit for detecting ions ejected from said mass analyzing unit, and a control unit for controlling a voltage applied to said mass analyzing unit, wherein, among ions trapped in said ion trap volume, singly-charged ions are selectively ejected out of the ion trap volume.

17. An ion trap type mass spectrometer in accordance with claim 16, wherein a supplementary AC voltage comprising a frequency component having a plurality of voltage values is applied to said end cap electrodes to scan.